REMARKS

To more particularly point out the subject matter of this invention, Applicant has amended claims 1, 3, 5, and 7 to insert in the preambles "with high strength and high corrosion resistance" after "martensitic stainless steel." The support for the insertion can be found in the Specification, page 1, lines 7-8. No new matter has been introduced.

Claims 1-8 are currently pending. Reconsideration of the application, as amended, is respectfully requested in view of the remarks below:

I

Claims 1, 3, 5, and 7 are rejected as by the Examiner as being obvious over U.S. Patent No. 5,415,706, issued to Scarlin *et al.* ("Scarlin"). Applicants respectfully traverse the grounds for rejection.

Among the rejected claims, claims 1 and 3 are drawn to martensitic stainless steel compositions, and claims 5 and 7 are drawn to methods of manufacturing the claimed martensitic stainless steels. Each of them, as amended, recites a composition containing, among others, 10-19 wt.% Cr (claims 1, 5 and 7) or 12-16 wt.% Cr (claim 3) and 1-6 wt.% Ni.

The Examiner asserts that

> "Scarlin disclosure a martensitic steel alloy with constituents whose wt% ranges overlap those recited by the claims. ... More specifically, note example A, lines 20 to 32, column 4 which meets the claimed composition but contains slightly lower amounts of Ni and Cr. It would, however, be obvious for one skilled person in the art and matter of routine optimizing to increase Cr and Ni, since broad ranges of 8 to 13% Cr and 0.05 to 2.0% Ni are taught." See the Office Action, page 2, lines 15-22.

Indeed, Scarlin discloses a composition containing 8-13 wt.% Cr and 0.05-2.0 wt.% Ni, which respectively overlap 10-19 or 12-16 wt.% Cr and 1-6 wt.% Ni recited in the rejected claims. However, regarding the Cr content, Scarlin states that "[a]n unduly high chromium content leads to the formation of δ-ferrite. The chromium content **should** thus be between 8 and 13, preferably between 8.5 and 11, percent by weight" (column 2, lines 61-65; emphasis added). In other words, Scarlin teaches away from a Cr content range that exceeds 13 wt.% Cr, as that recited in all of the rejected claims. Similarly, Scarlin teaches away from a Ni content over 2 wt.%, as evidenced by a statement: "[h]igh nickel contents lead to an inadmissible lowering of

the A_{c1} temperature, so that an annealing treatment at high temperatures will no longer be possible. For this reason, the nickel content **should** be between 0.05 and 2, and preferably between 0.3 and 1, percent by weight" (column 2, lines 50-56; emphasis added). Thus, Scarlin teaches away from a Ni content range that exceeds 2 wt.%, as that recited in all of the rejected claims.

Applicant would like to further point out that he first recognized the applicability of such high Cr and Ni contents. Contrary to the Scarlin's teachings, seven compositions containing over 13 wt.% Cr and over 2 wt.% Ni were unexpectedly found to possess high mechanical strength and corrosion resistance. See Examples 2-8 at pages 9-13 of the Specification.

In view of the above remarks, Applicants submit that claims 1, 3, 5, and 7 are not rendered obvious by Scarlin.

The Examiner further asserts that

> "[i]n regard to the method claim, note that Scarlin et al. on lines 1 to 11 of column 4 subjects steel to casting, austenitize annealing at 1150C (within applicant's annealing temperature range of 800-1150C) followed by tempering at 780C (slightly higher than applicant's claimed tempering temperature of 350 to 575C). It is the examiner's position that tempering is a well known conventional practice ... and would be a matter of choice well within the skill of the artisan and productive of no new and unexpected results." See the Office Action, page 3, lines 5-12.

Applicant disagrees. Each of method claims 5 and 7 covers a method of manufacturing a martensitic stainless steel that is nonobvious over Scarlin, and is therefore not rendered obvious by Scarlin. In other words, neither claim 5 nor claim 7 bases its patentability on the recited tempering temperature of 350-575°C.. Nevertheless, Applicant would like to address this issue raised by the Examiner.

Indeed, tempering is a conventional practice. Thus, an artisan would know that the tempering temperature affects the formation of a large carbide such as $(CrFe)_4C$ (i.e., $(Cr, Fe)_{23}C_6$). See Pickering (1978) "Physical Metallurgy and the Design of Steels," Applied Science Publishers Ltd. (attached hereto as "Exhibit A"). More specifically, as shown in Pickering, in a composition containing 12 wt.% Cr and less than 0.06 wt.% C, the steel at a temperature of 780°C is in a form totally different from that at a temperature below 575°C, α (i.e., Cr_7C_3) vs. α

+ $(CrFe)_4C$ (i.e., Cr_7C_3 and $(Cr, Fe)_{23}C_6$) co-existence). In view of Pickering, an artisan would not have been motivated to lower the tempering temperature from 780°C to 350-575°C. Therefore, Scarlin, which is totally silent on a tempering temperature lower than 780°C, does not render method claims 5 and 7 obvious.

II

Claims 2, 4, 6, and 8 are rejected as being obvious over Scarlin as applied to claims 1, 3, 5, and 7 above, and further in view of the English abstract of Japanese Patent No. 402217444A (JP '444A).

Unlike claims 1, 3, 5, and 7, the rejected claims 2. 4. 6, and 8 further recite 0.8 wt.% Ti and 1 wt.% Ta. According to the Examiner, even though Scarlin "fails to include Ti and/or Ta" "they are chemically equivalent to V and Nb ... [and] it is a common practice in the art to incorporate V, Nb, Ti and Ta to form carbides and nitrides in a martensitic stainless steel, as evident by the English abstract of JP'444A." See the Office Action, page 3, lines 16-22. Applicant disagrees.

Claims 2 and 4, dependent from claims 1 and 3, respectively, cover martensitic stainless steel compositions. On the other hand, claims 6 and 8, dependent from claims 5 and 7, respectively, cover methods of manufacturing martensitic stainless steels. As such, claims 2, 4, 6, and 8 are not rendered obvious by Scarlin for the same reasons set forth above. JP' 444A only teaches a composition containing, among others, V, Nb, Ti, and Ta. It fails to cure the deficiency in Scarlin. Thus, a combination of Scarlin and JP '444A also does not render claims 2, 4, 6, and 8 obvious.

CONCLUSION

For the reasons stated above, Applicant submits that the grounds for the rejection asserted by the Examiner have been overcome, and that the claims, as pending, define subject matter that is novel and nonobvious over the prior art.

Attached hereto is a marked-up version of the changes being made by the current amendment.

Applicant asks that all claims be allowed. Please apply any other charges to Deposit Account No. 06-1050.

Respectfully submitted,

Date: 12-16-02

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

Claims 1, 3, 5, and 7 have been amended as follows:

1. (Twice Amended) A martensitic stainless steel with high strength and high corrosion resistance comprising less than 0.06 wt.% C, less than 2.5 wt.% Si, less than 2.5 wt.% Mn, 1.0-6.0 wt.% Ni, 10.0-19.0 wt.% Cr, 0.5-6.0 wt.% W, less than 3.5 wt.% Mo, less than 0.5 wt.% Nb, less than 0.5 wt.% V, less than 3.0 wt.% Cu, 0.11-0.25 wt.% N, and the remainder being Fe and minor impurities.

3. (Twice Amended) A martensitic stainless steel with high strength and high corrosion resistance comprising less than 0.035 wt.% C, less than 2.0 wt.% Si, less than 2.0 wt.% Mn, 1.5-4.5 wt.% Ni, 12.0-16.0 wt.% Cr, 0.5-4.5 wt.% W, less than 2.5 wt.% Mo, less than 0.3 wt.% Nb, less than 0.3 wt.% V, less than 2.0 wt.% Cu, 0.11-0.25 wt.% N, and the remainder being Fe and minor impurities.

5. (Twice Amended) A method for manufacturing a martensitic stainless steel with high strength and high corrosion resistance comprising the steps of:

casting a stainless steel that comprises less than 0.06 wt.% C, less than 2.5 wt.% Si, less than 2.5 wt.% Mn, 1.0-6.0 wt.% Ni, 10.0-19.0 wt.% Cr, 0.5-6.0 wt.% W, less than 3.5 wt.% Mo, less than 0.5 wt.% Nb, less than 0.5 wt.% V, less than 3.0 wt.% Cu, 0.11-0.25 wt.% N, and the remainder being Fe and minor impurities; and

submitting the cast stainless steel to an austenization heat treatment at a temperature of 800-1150°C and/or tempering the stainless steel at a temperature of 350-575°C.

7. (Twice Amended) A method for manufacturing a martensitic stainless steel with high strength and high corrosion resistance comprising the steps of:

casting a stainless steel that comprises less than 0.06 wt.% C, less than 2.5 wt.% Si, less than 2.5 wt.% Mn, 1.0-6.0 wt.% Ni, 10.0-19.0 wt.% Cr, 0.5-6.0 wt.% W, less than 3.5 wt.% Mo,

less than 0.5 wt.% Nb, less than 0.5 wt.% V, less than 3.0 wt.% Cu, 0.11-0.25 wt.% N, and the remainder being Fe and minor impurities;

mechanically-processing the stainless steel such that work hardening is generated in the stainless steel; and

submitting the mechanically-processed stainless steel to an austenization heat treatment at a temperature of 800-1150°C and/or tempering the stainless steel at a temperature of 350-575°C.

PHYSICAL METALLURGY AND THE DESIGN OF STEELS

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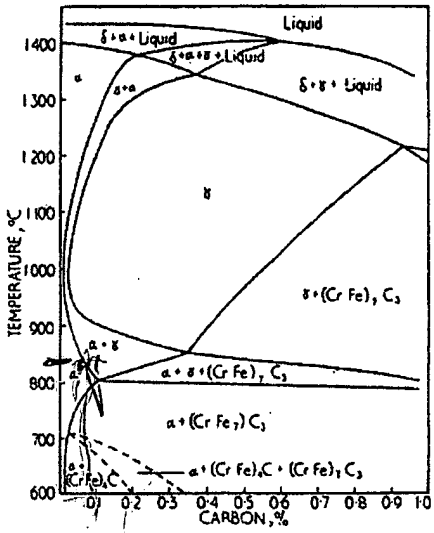
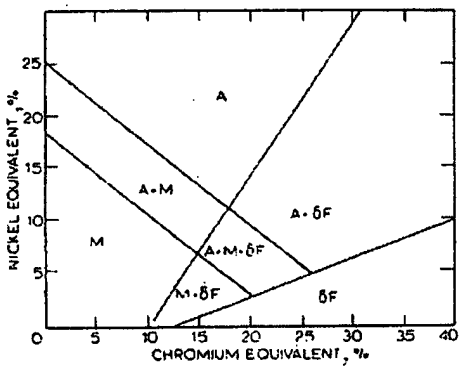


Fig. 8.2. Effect of carbon on the equilibrium relationships in 12%Cr steels.



A = austenite; M = martensite; δF = delta-ferrite

Fig. 8.3. Effect of nickel and chromium equivalents on constitution of stainless steels (Schaeffler diagram).